epic4
Configuration and Administration Guide

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System Details

This is the system as purchased from Compusys in September 2003.

- **Chieftec full tower DA-01WD case:**
  360W ATX PSU;
  2 x 3.5" bays;
  6 x 5.25" bays;
  Dimensions: 738 x 548 x 276mm;
  More details from http://www.chieftec.com/products/dragon/da01wd.htm
- **Intel SE7505VB2 Workstation Dual Xeon motherboard:**
  Intel E7505 chipset;
  533MHz system bus;
  Dual integrated PRO network connections (1 x 10/100Mb/s, 1 x 10/100/1000Mb/s);
  Integrated Serial ATA x 2 with integrated RAID;
  Support for up to 8GB of ECC DDR266 SDRAM;
  5 x PCI slots with support for PCI-X cards;
  AGP connector supporting 1.5CV AGP 8x Pro50 cards;
  2 x ATA100 IDE connector;
  Integrated ATI Rage XL video controller with 8MB;
  2 x serial (one internal), 1 x parallel, 4 x USB (one internal);
  PS/2 keyboard and mouse connectors;
  More details from
  http://www.intel.com/support/motherboards/server/se7505vb2/index.htm
- **2 x Intel Xeon 3.06GHz 512kB cache processor with 533MHz FSB**
- **4 x 1GB registered low profile DDR memory**
- **Matrox Millennium G550 Dual Head graphics card**
  More details from http://www.matrox.com/mga/products/g550_dualdvi/home.cfm
- **3.5" floppy disc drive**
- **2 x Maxtor 7Y250P0 250GB HDD**
- **1 x Maxtor 6Y080L0 80GB HDD**
- **Cherry 105-key PS/2 OEM keyboard**
- **Microsoft wheel mouse**
- **Desktop 60 months on-site warranty (8 business hours)**

System purchased from Compusys PLC, September 2003. Quotation reference 139797.

Compusys serial number: 1056929
University of Leicester serial number: 01844

Compusys PLC
Brooklands Court
Tunstall Road
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Tel: 0113 3830238
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http://www.compusys.co.uk/

Operating System

epic4 is installed with Redhat 7.3 Linux. As of 25 September 2003, it is fully patched and updated.

Patches and updates can be applied through the Redhat update service. Running **up2date** from a terminal will start the updater, and allow you to select and install any new updates to the system. The account details for epic4 on Redhat's Redhat Network (RHN) service at https://rhn.redhat.com/ are:

Username: xmm-epic
Password: qwerty

To be able to continue to get free support via RHN, it is necessary to respond to a Redhat web-based questionnaire roughly once every two months. Details of these are emailed to the account holder, and they only take a minute or two to complete.

There are two PCI cards within epic4 which have been brought over from the old machine: an Adaptec AIC-7892A U160 Ultra SCSI adapter, and a Maxtor UDMA adapter to support two of the internal IDE discs that otherwise couldn't be installed. With this arrangement, there is support for up to 8 IDE devices within epic4, in addition to two Serial ATA devices that can be attached to the motherboard connectors. However there is little room left within epic4's case for more discs, and any additions will probably require a larger PSU and certainly additional cooling fans and Y-connectors to provide more power plugs.

The SCSI adapter can be used to attach up to 15 SCSI devices. Currently there are five SCSI discs housed in a Sun external drive enclosure, and an internally-mounted DDS4 tape drive.

There are several discs to epic4. Table 1 shows details of all the discs (including CD-RW and DAT DDS4 drives). Refer to figures 1 and 2 for their physical locations within epic4 and the external disc enclosure.

The external disc enclosure is an old Sun unit left over from epic2 (a Sun Ultra 5) which was our main workstation prior to epic4, and retired in August 2000. The enclosure can accommodate up to six Ultra2 SCSI discs. A switch on the back of the unit allows SCSI IDs to be selected in the range 1-6 or 9-15. For epic4's use the switch is in the 1-6 range and shouldn't be changed.

Manufacturer	Type	Capacity	Device	Connection
Maxtor	6Y080L0	76GB	hda	Mobo IDE 1 (master)
Teac	CD-W54E	CD-RW	hdb	Mobo IDE 1 (slave)
Maxtor	7Y250P0	233GB	hdc	Mobo IDE 2 (master)
Maxtor	7Y250P0	233GB	hdd	Mobo IDE 2 (slave)
Maxtor	4A250J0	233GB	hde	PCI UDMA 1 (master)
Maxtor	4A250J0	233GB	hdf	PCI UDMA 1 (slave)
Seagate	ST150176LC	50GB	sda	SCSI ID 1
Seagate	ST150176LC	50GB	sdb	SCSI ID 2
Seagate	ST173404LC	72GB	sdc	SCSI ID 3
Seagate	ST336704LC	36GB	sdd	SCSI ID 4
Seagate	ST318275LC	18GB	sde	SCSI ID 5
Seagate	DDS4 DAT	DDS4	rst0	SCSI ID 15

Table 1 - epic4's discs

Figure 1 - SCSI discs within external drive enclosure

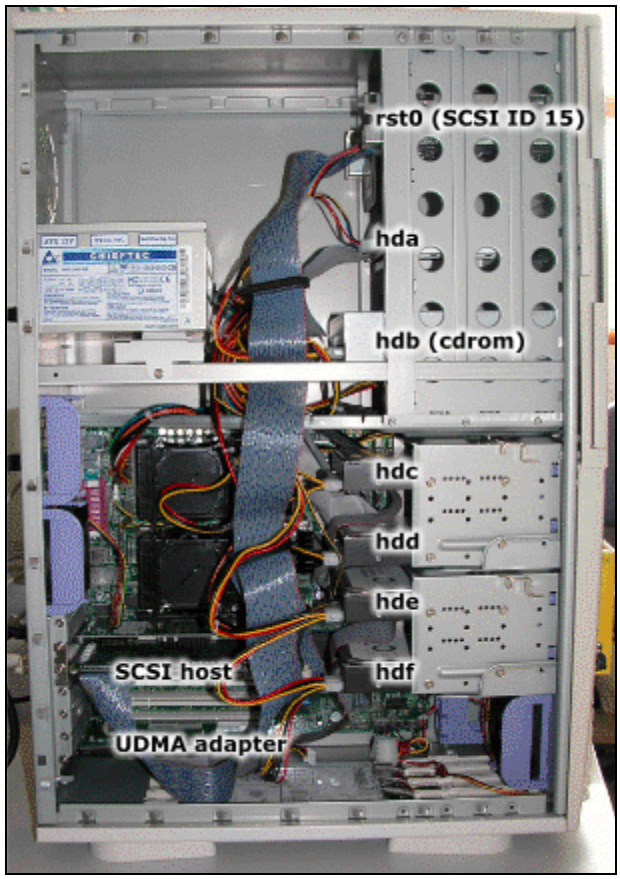

Figure 2 - Discs within main system box

Table 2 shows how the discs are partitioned, the *approximate* size of each partition, and where on the filesystem they are mounted. All the discs use the Linux (type 0x83) format, except for those configured to be Physical Volumes for use by the Logical Volume Manager (LVM) – these use the Linux LVM (type 0x8e) format.

Currently, only hde2 and hdf1 are setup to be part of a Logical Volume. Logical Volumes are large virtual partitions made up of several smaller disc partitions. The logical volume `/dev/vg_data/flight` contains all the XMM flight data we receive. As the amount of data increases beyond the capacity of the logical volume, extra discs can be added to the volume to increase its size without having to resort to hack such as multiple partitions with softlinks unifying the file structure. The vg_data volume can be extended to a maximum size of 2TB.

More details about LVM can be found at http://tldp.org/HOWTO/LVM-HOWTO/.

All filesystems use the journalled ext3 filesystem for resilience to system crashes.

Device	Mount point	Size	Start block	End block
hda1	/boot	100MB	1	203
hda2	/	2GB	204	4364
hda3	/usr	20GB	4365	45974
hda5	swap (virtual memory)	4GB	45975	54296
hda6	/tmp	1GB	54297	56377
hda7	/var	512MB	56378	57417
hda8	/home	48GB	57418	158816
hdc1	/work	233GB	1	30515
hdd1	/xmm/current	233GB	1	30515
hde1	Unused	53MB	1	7
hde2	/xmm/archive/flight PV	190GB	8	30515
hdf1	/xmm/archive/flight PV	233GB	1	30515
sdc1	/xmm/archive/ground	72GB	1	8924

Table 2 - Disc partitions

Currently, only SCSI disc, sdc, is in use. The other SCSI discs are left over from the previous epic4 machine and can be used as necessary to extend the vg_data LV or for mirroring of other drives for backup purposes.

Some general useful information about the filesystems and discs are given below.

Dump of /etc/fstab:

```
/dev/hda1               /boot                   ext3    defaults                1 2
/dev/hda2               /                       ext3    defaults                1 1
/dev/hda3               /usr                    ext3    defaults                1 2
/dev/hda5               swap                    swap    defaults                0 0
/dev/hda6               /tmp                    ext3    defaults                1 2
/dev/hda7               /var                    ext3    defaults                1 2
/dev/hda8               /home                   ext3    defaults                1 2

none                    /dev/pts                devpts  gid=5,mode=620          0 0
none                    /proc                   proc    defaults                0 0
none                    /dev/shm                tmpfs   defaults                0 0

/dev/fd0                /mnt/floppy             auto    noauto,owner,kudzu      0 0
/dev/cdrom              /mnt/cdrom              iso9660 noauto,owner,kudzu,ro   0 0

/dev/hdc1               /work                   ext3    defaults                1 2
/dev/hdd1               /xmm/current            ext3    defaults                1 2

/dev/sdc1               /xmm/archive/ground     ext3    ro                      1 2

epic3:/ftp/pub/cal      /mnt/epic3/cal-pv       nfs     defaults                0 0
```

Physical discs are highlighted. You'll notice that `/xmm/archive/flight` isn't listed in `fstab` with the other filesystems. Redhat 7 doesn't seem to activate volume groups automatically on booting, so this is dealt with in `/etc/rc.local`:

```
# Activate the 'archive' volume group and mount the flight logical vols
echo 'Activating the volume groups...'
/sbin/vgchange vg_data -ay
sleep 2
echo 'Mounting the 'flight' logical volume...'
mount /dev/vg_data/flight /xmm/archive/flight
```

hdc1 Formatting Information:

```
> /sbin/mke2fs /dev/hdc1
mke2fs 1.27 (8-Mar-2002)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
30654464 inodes, 61277926 blocks
3063896 blocks (5.00%) reserved for the super user
First data block=0
1871 block groups
32768 blocks per group, 32768 fragments per group
16384 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
        4096000, 7962624, 11239424, 20480000, 23887872

Writing inode tables: done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 37 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
```

hdd1 Formatting Information:

```
> /sbin/mke2fs /dev/hdd1
mke2fs 1.27 (8-Mar-2002)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
30654464 inodes, 61277926 blocks
3063896 blocks (5.00%) reserved for the super user
First data block=0
1871 block groups
32768 blocks per group, 32768 fragments per group
16384 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
        4096000, 7962624, 11239424, 20480000, 23887872

Writing inode tables: done
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 37 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
```

When I first set epic4 up, I discovered a problem with the SCSI system which seemed to be related to APIC (the Advanced Programmable Interrupt Controller). Therefore I have disabled APIC in the kernel boot configuration in `/boot/grub/grub.conf` by adding the kernel argument **`apic=off`**. Another kernel argument maps the CD-RW drive (/dev/hdb) to the IDE-SCSI emulation modules, to allow CD writing functions to work. This argument is **`hdb=ide-scsi`**.

Network Services and Security

epic4 is part of the Starlink subnet. The network details are shown below, and they're bound to NIC eth0 (eth1, also on the motherboard, is unused and not configured):

FQDN	epic4.star.le.ac.uk
IP address	143.210.36.52
Mask	255.255.255.0
Gateway	143.210.36.36
DNS1	143.210.12.154
DNS2	143.210.12.152

epic4 is secured from access via the internet by an iptables-based firewall. The firewall restricts access to all services except as shown in table 3. Outbound traffic has no restrictions.

Protocol	Service	Port(s)	Allowed from
ICMP	-	-	Anywhere
TCP and UDP	ssh	22	Anywhere
TCP and UDP	ntp	123	Anywhere
TCP and UDP	NFS	111, 2049, 32000-32999	epic3.xra.le.ac.uk
UDP	netbios-ns	137	xra.le.ac.uk
UDP	netbios-dgm	138	xra.le.ac.uk
TCP and UDP	netbios-ssn	139	xra.le.ac.uk

Table 3 - epic4 network services

The full iptables list of rules is stored in `/etc/sysconfig/iptables`. This isn't the best place for them – inadvertently running **`/etc/init.d/iptables save`** with the tables in the wrong state will overwrite the rules. The rules are as follows:

```
Chain INPUT (policy DROP)
target     prot opt source               destination
DROP       all  -f  anywhere             anywhere
DROP       all  --  127.0.0.0/8          anywhere
ACCEPT     all  --  anywhere             anywhere
ACCEPT     icmp --  anywhere             anywhere    icmp echo-request
ACCEPT     tcp  --  anywhere             anywhere    tcp dpt:ssh flags:SYN,RST,ACK/SYN
ACCEPT     tcp  --  anywhere             anywhere    tcp dpt:ntp
ACCEPT     udp  --  anywhere             anywhere    udp dpt:ntp
ACCEPT     udp  --  143.210.40.0/24      anywhere    udp dpt:netbios-ns
ACCEPT     udp  --  143.210.40.0/24      anywhere    udp dpt:netbios-dgm
ACCEPT     tcp  --  143.210.40.0/24      anywhere    tcp dpt:netbios-ssn
ACCEPT     udp  --  143.210.40.0/24      anywhere    udp dpt:netbios-ssn
ACCEPT     all  --  anywhere             anywhere    state RELATED,ESTABLISHED
REJECT     all  --  anywhere             anywhere    state NEW reject-with icmp-proto-unreachable

Chain FORWARD (policy DROP)
target     prot opt source               destination

Chain OUTPUT (policy ACCEPT)
target     prot opt source               destination
ACCEPT     all  --  anywhere             anywhere
ACCEPT     tcp  --  anywhere             anywhere    state NEW,ESTABLISHED
ACCEPT     udp  --  anywhere             anywhere    state NEW,ESTABLISHED
ACCEPT     icmp --  anywhere             anywhere    state NEW,RELATED,ESTABLISHED
```

Complete documentation on iptables can be found at http://www.netfilter.org/.

There isn't much in the way of system monitoring performed. Logs go into `/var/log`, and are configured in `/etc/syslog.conf` with log rotation setup in `/etc/logrotate.conf` to prevent the `/var` partition filling up over time. Some log details are mailed daily to whoever root is

aliased to in /etc/aliases. Currently I just keep an eye on ssh logins and mail leaving the system. The mechanism for the daily log reports is called **logwatch**, and is configured in /etc/log.d.

Each service and its configuration details are outlined below.

SSH

The ssh daemon's configuration and public/private key pairs are stored in /etc/ssh. The only changes from the default configuration are:

- only SSH version 2 connections are allowed (there are security issues with the version 1 protocol)
- root logins are disallowed (you must login as a normal user and use **su** to become root)
- X11 forwarding is turned on

SSH connections can be made to epic4 from anywhere, without restriction. Because X11 traffic is tunnelled through ssh, direct X logins have been switched off. As long as your ssh client knows how to tunnel X and you have an X11 server, there is no need to set the DISPLAY environment variable, and the tunnel will work through firewalls and masqueraded connections.

NTP

NTP is the Network Time Protocol, and is used to keep the clocks synchronised accurately between hosts. epic4 has a very simple NTP setup – its clock is synchronised to that of dms1.xra.le.ac.uk, which in turn is synchronised with the Campus time service.

The NTP configuration file is /etc/ntp.conf.

The University's NTP service is documented at http://www.le.ac.uk/cc/nss/ntp/. The NTP protocol itself can be found at http://www.ntp.org/.

NFS

For historical reasons, epic4 allows NFS exports to be mounted on epic3, though there are currently no filesystems exported.

Because NFS uses dynamic port numbers above 32000 for its connections, the iptables rules aren't as clean as they ought to be. As a workaround, ports 111 (portmapper), 2049 (nfsd) and all ports between 32000 and 32999 inclusive are allowed to accept connections from epic3.

A solution to this is to ensure that the NFS-related services rpc.rquotad, rpc.statd, rpc.lockd and rpc.mountd are altered to use fixed ports. I haven't got round to this, but details can be found at http://librenix.com/?inode=3081.

As epic3 is the EPIC FTP server, a portion of epic3's FTP filesystem is exported and mounted on epic4 under /mnt/epic3/cal-pv.

SMB (NetBIOS)

Primarily for Tony's convenience, some directories are shared via SMB to allow them to be seen in the Windows Network Neighbourhood in the SRC.

epic4 announces itself as a member of the **SRC_RESEARCH** workgroup, with the name **XRA-EPIC4-G16**. It does not attempt to contact a domain controller (there is no domain control in the SRC), but it announces itself to dms1.xra.le.ac.uk which provides a WINS service. If dms1 goes offline or its WINS service is switched off, epic4 will no longer be visible to Windows users.

The SMB configuration files can be found in `/etc/samba`. The following directories are shared:

- /xmm/archive (shared as **archive**)
- /xmm/current (shared as **current**)
- home directories (shared as the user's username)

None of these are visible to anyone without a valid SMB username and password. The vagaries of sharing authentication schemes between Linux and Windows won't be explained here. Suffice to say that the setup is far from ideal without a domain controller for Windows. Windows users wishing to be able to see these shares will need a SMB username and password that matches their Windows logon username and password – though whether this works depends on the version of Windows in question (WinXP and Win2000 offer the least resistance).

The SMB username and password is separate from the epic4 username and password and the two aren't synchronised. To create a new SMB username and password, use the following command:

`smbpasswd -a` ***user***

where ***user*** is the username. You will be prompted for the user's password. The password should be identical to that used for logging into Windows.

Details about SMB (also known as Samba) can be found at http://www.samba.org/.

SMB connections are restricted by iptables to only allow connections from the SRC, specifically the xra.le.ac.uk domain.

Email

There is no mail transfer agent (MTA) running on epic4, though `sendmail` is installed and is used for outgoing system mail. The `sendmail` configuration file is `/etc/sendmail/cf` with additional files within `/etc/mail`.

The only aspect of `sendmail` likely to need altering is the alias for root. Currently root is aliased to me (as ljg@star.le.ac.uk), where all system-related mail is delivered. The mail aliases are in `/etc/aliases`, with the root alias at the end of the file, as so:

```
# Person who should get root's mail
root:           ljg@star.le.ac.uk
```

If altered, the command **`newaliases`** must be run (as root) before any changes will take effect.

For normal users, pine is installed as a mail client. The global pine configuration file is `/etc/pine.conf`, and this has been setup to use the Starlink mail host (mail.star.le.ac.uk) for outgoing mail (via SMTP) and incoming mail (via IMAP). Using `pine` with IMAP as the transport

means that users' mailboxes remain on the Starlink systems. Users' local pine configuration files will be found in their home directories, as `.pinerc`.

Other email clients installed on epic4 are Mozilla, Evolution and mutt.

Users and Groups

There are seventeen normal (i.e. non-system) users with accounts on epic4. Some of these are unused and locked, but still present as those users' files are still present and in use. Table 4 shows their details, replicating the information within `/etc/passwd`.

Username	Real name	Groups	Status
sse	Steve Sembay	xra, epic	Active
rds	Richard Saxton	xra	Active
md	Mike Denby	xra, epic	Active
afa	Tony Abbey	xra, epic	Active
adts	Alex Short	xra, epic	**Locked**
rgg	Gareth Griffiths	xra, epic	**Locked**
ljg	Liam Gretton	xra, epic	Active
pbe	Paul Bennie	xra, epic	Active
jnr	James Reeves	xra	**Locked**
rma	Richard Ambrosi	xra	Active
tm	Theresa Mineo	xra	**Locked**
kpa	Kim Page	xra, epic	Active
dbl	Darren Baskill	xra, epic	Active
km77	Kallol Mukerjee	xra	Active
amr30	Andy Read	xra, epic	Active
guest1	Guest Account 1	xra	**Locked**
epic	epic4 admin	xra, epic	**Locked**

Table 4 - User details

A locked status means that the user's account is either explicitly locked (with **`passwd -l`**) or has no password set (users cannot login with a null password). I never delete accounts as they become unused, as it makes future audits of file ownership and so on impossible; should a user leave the system, it is safer to lock their account and keep their details, deleting their home directories to save space if necessary.

Usernames and user and group IDs are identical to their counterparts on the Starlink systems, so should epic4 ever be brought under the control of Starlink, the transition shouldn't be too painful. The only exception is the `epic` group, which was created to separate non-calibration XMM data from everything else in the `xra` group that all our users are allowed access to. The `epic` group has GID 2000.

Each user has a home directory under `/home`, named after their username. Each user also has his or her own directory under `/work`. Neither of these have any quotas enforced.

The `epic` user account is a throwback to the old epic4 system, and is now unused.

Users are created with the following command:

`useradd -u` ***`uid`*** **`-g xra -d /home/`**`user` **`-s /bin/tcsh -c "`**`Real Name`**`" -M`** ***`user`***

The username ***`user`*** and its associated user ID ***`uid`*** must be discovered by asking one of the Starlink administrators. Non-Starlink users should be given access to the guest account, more of which can be added as necessary. The **`-M`** switch to **`useradd`** creates the home directory, using the template `/etc/skel`, which contains nothing much more than the common `.cshrc`, `.coloursrc` and `.login` files that each user needs.

An alternative way of discovering a Starlink user's UID and GID is to run this short Perl program on any of the Starlink systems:

```
#!/usr/bin/perl
#
# Returns users' uid and gid numbers
# Liam, June 1999

($name,$passwd,$uid,$gid,$quota,$comment,$gcos,$dir,$shell) = getpwnam($ARGV[0]);

print "User $ARGV[0] ($comment):\n";
print "uid = $uid\n";
print "gid = $gid\n";
```

Save this as an executable called **getuid** and run with a username as an argument:

```
> getuid ljg

User ljg (Liam Gretton):
uid = 317
gid = 333
```

User login process

All users have tcsh as their login shell. When a user logs in, the contents of the following files are executed in order:

- /etc/csh.cshrc
- /etc/csh.login
- ~/.cshrc
- ~/.login

Therefore, common environment variables and setup scripts are generally initialised in /etc/csh.cshrc (the login files I haven't altered from the standard install).

Software

Any software which is related to the system in any way, especially if it can be found on Redhat's website, is installed using the Redhat Package Manager (RPM) whenever possible.

Other software from other sources (e.g. SAS, IDL) is installed in `/usr/local`, often built from source.

A convention I tend to follow is to install software in a directory of its own in /usr/local, with the directory name including the version number (e.g. acrobat-5.0.8). A softlink is then created to point to this directory, but without the version number (e.g. acrobat). This way, new versions of the software can be installed without disturbing the old one, and all that needs to be done is to have the softlink renamed to point to whichever version should be regarded as current. A listing of some of the current contents of /usr/local should give a clearer picture. Directories are coloured **blue**, and softlinks are **purple**:

```
lrwxrwxrwx    1 root     root           13 Sep 25 16:15 acrobat -> acrobat-5.0.8
drwxr-xr-x    6 root     root         4096 Sep 25 16:15 acrobat-5.0.8
lrwxrwxrwx    1 root     root           12 Sep 26 18:57 atomdb -> atomdb-1.3.1
drwxr-xr-x    3 root     root         4096 Aug 19 10:41 atomdb-1.3.1
drwxr-xr-x    2 root     root         4096 Sep 30 15:41 bin
lrwxrwxrwx    1 root     root           10 Sep 27 02:07 caldb -> caldb-2.23
drwxr-xr-x    5 root     root         4096 Aug 19 09:59 caldb-2.23
lrwxrwxrwx    1 root     root            8 Sep 27 02:06 ciao -> ciao-3.0
drwxr-xr-x   12 root     root         4096 Aug 19 10:46 ciao-3.0
drwxr-xr-x    2 root     root         4096 Feb  6  1996 doc
drwxr-xr-x    2 root     root         4096 Feb  6  1996 etc
drwxr-xr-x    2 root     root         4096 Feb  6  1996 games
drwxr-xr-x   10 root     root         4096 Sep 19  2000 grace
lrwxrwxrwx    1 root     root           13 Sep 25 16:29 ICAClient -> ICAClient-7.0
dr-xr-xr-x   13 root     sys          4096 Sep 25 16:29 ICAClient-7.0
lrwxrwxrwx    1 root     root            7 Sep 25 16:58 idl -> rsi/idl
drwxr-xr-x    3 root     root         4096 Sep 30 12:34 include
drwxr-xr-x    8 root     root         4096 Feb 11  2003 j2sdk1.4.1
drwxr-xr-x    9 root     root         4096 Sep 30 12:23 j2sdk1.4.2_01
lrwxrwxrwx    1 root     root           13 Sep 30 12:23 java -> j2sdk1.4.2_01
drwxr-xr-x    3 root     root         4096 Sep 30 12:33 lib
drwxr-xr-x    2 root     root         4096 Jun 22  2001 libexec
drwxrwxrwx   12 root     root         4096 May 28 18:18 mostools
lrwxrwxrwx    1 root     root           12 Sep 26 19:09 pgplot -> pgplot-5.2.2
drwxr-xr-x    2 root     root         4096 Apr 23  2001 pgplot-5.2.2
drwxr-xr-x    2 root     root         4096 Nov 22  2000 pms2odf
drwxr-xr-x    5 root     root         4096 Sep 25 17:23 rsi
lrwxrwxrwx    1 root     root            6 Sep 28 14:23 sas -> xmmsas
drwxr-xr-x    2 root     root         4096 Feb  6  1996 sbin
lrwxrwxrwx    1 root     root           12 Sep 26 19:09 scisim -> scisim-3.0.0
drwxrwxr-x    7 root     root         4096 Sep 26 19:09 scisim-3.0.0
drwxr-xr-x   19 root     root         4096 Sep 21  2001 scisim-3.0.0-src
drwxr-xr-x    8 root     root         4096 Nov  7  2001 scisim_v2.1.a20000427
drwxr-xr-x    5 root     root         4096 Sep 30 11:20 share
drwxr-xr-x    2 root     root         4096 Feb  6  1996 src
drwxr-xr-x    5 root     root         4096 Oct  2  2000 vqa
lrwxrwxrwx    1 root     root           20 Sep 27 02:07 xmmsas -> xmmsas_20030110_1802
drwxrwsr-x    8 root     root         4096 Feb  6  2003 xmmsas_20030110_1802
drwxr-xr-x    2 root     root         4096 Sep 19  2000 xpa
```

With this scheme, multiple versions of the same software can be maintained with ease. Environment variables need only point to the softlinks, which can be changed whenever necessary to link to any particular version of the installed software.

For example: the Java Software Development Kit (SDK) is installed in `/usr/local/j2sdk1.4.2_01` with an older version still present in `j2sdk1.4.1`. A softlink called `/usr/local/java` has been created to point to it. The global cshrc file (`/etc/csh.cshrc`) adds the SDK to the users' run path, but uses the `/usr/local/java` link. If we wish to roll back to the previous version, only the `java` softlink needs to be changed and that's it.

There are some core applications installed on epic4, some of which are listed in table 5.

Application	Description	From	Installed
Adobe Acrobat	PDF reader	http://www.adobe.com/	5.0.8
CIAO	Chandra data analysis	http://cxc.harvard.edu/ciao/	3.0
ICA client	Citrix Metaframe client	http://www.citrix.com/	7.0
IDL	Data analysis	http://www.rsinc.com/	6.0
Java SDK	Java development and VM	http://java.sun.com/	1.4.2
HEASOFT	Data analysis	http://heasarc.gsfc.nasa.gov/	5.2
SCISIM	XMM science simulator	http://xmm.vilspa.esa.es/	3.0.0
XMM SAS	XMM data analysis	http://xmm.vilspa.esa.es/	5.4.1
Grace	2D plotting	http://plasma-gate.weizmann.ac.il/	5.1.3
DS9	Data visualisation	http://hea-www.harvard.edu/	2.1b4
Mozilla	Web browser	http://www.mozilla.org/	1.4

Table 5 - Some core epic4 applications

Mozilla and plugins

Though Mozilla is installed as a base package with Redhat 7.3, I have always made an effort to keep it up to date, as Mozilla is under constant development and its new features are invariably useful. Mozilla RPMs can be downloaded from the Mozilla website.

Acrobat and the Java SDK provide plugins for Mozilla. Mozilla's plugins are stored in `/usr/lib/mozilla/plugins` – as I've created softlinks to these, they should survive any upgrades of Mozilla, Java and Acrobat.

IDL

IDL is one of our most used applications, and also the one that causes the most problems with upgrades and changes to the system because of its copy protection scheme.

IDL runs a licence manager daemon (called `lmgrd`) which requires a valid licence file. Without a valid licence file or if the daemon stops for some reason, IDL runs in demonstration mode allowing only seven minutes of operation before it shuts down.

Our IDL licence allows six concurrent instances of IDL to run. The licence manager daemon is started at boot time by a couple of commands in `/etc/rc.local`:

```
# Start the IDL licence manager
export LM_LICENSE_FILE=/usr/local/rsi/license/license.dat
/usr/local/idl/bin/lmgrd -c /usr/local/rsi/license/license.dat >> /var/log/rsi_lmgrd
```

`license.dat` is the IDL license file – this is provided by RSI. Whenever a new version of IDL is released, RSI send me a new license file to go with it. Enquiries about IDL license matters should be directed to uksupport@rsinc.com.

Libraries for IDL which aren't supplied with IDL itself belong in `/usr/local/lib/idl`. The environment variable `IDL_PATH`, set in `/etc/csh.cshrc` points to this directory – anything within it is available to IDL.

Currently, only the IDL Astronomy Library (from http://idlastro.gsfc.nasa.gov/homepage.html) is present there.

Routine EPIC duties

There are a number of routine tasks related to EPIC, mainly in retrieving calibration data and housekeeping (SPEVAL) files.

Calibration data

Approximately once a week, I receive an email notification from Michael Kirsch (mkirsch@xmm.vilspa.esa.es) of new cal closed data. This data I manually transfer to epic4 by ftp, into a staging directory /xmm/archive/flight/orbits/latest before unpacking into the /xmm/archive/flights/orbits directory. Softlinks to the data are created in /xmm/current/flight/calve/orbits.

Though this is a manual operation, the steps are always the same and boil down to little more than half a dozen commands or so. A cal closed download and unpacking session is shown below. There is no need to be the root user to do this – any regular user can follow this procedure. User input is highlighted in **blue**.

Note that the username and password to use at the Vilspa FTP prompt is:

Username: epic_ex
Password: 20epic_ex02

```
> cd /xmm/archive/flight/
> ftp xmm.vilspa.esa.es
Connected to xmm.vilspa.esa.es (193.147.152.102).
220-    Welcome to the XMM-Newton SOC ftp server
220-
220 xmm.vilspa.esa.es FTP server ready.
Name (xmm.vilspa.esa.es:ljg): epic_ex
331 Password required for epic_ex.
Password: 20epic_ex02
230-XMM-Newton SOC - European Space Agency (ESA)
230-Villafranca del Castillo, Madrid, Spain
230----------------------------------------------------------------------
230-Time: Fri Oct  3 13:16:47 2003.
230-
230-You are entering as epic_ex from epic4.star.le.ac.uk.
230-
230-Server maintained by ftp-admin
230-
230-Last update: June 14, 2002
230----------------------------------------------------------------------
230-
230-
230 User epic_ex logged in.  Access restrictions apply.
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> cd new_week/calclosed
250 CWD command successful.
ftp> ls
227 Entering Passive Mode (193,147,152,102,124,9)
150 Opening ASCII mode data connection for /bin/ls.
total 218974
-rw-r--r--   1 users    112104770 Sep 26 14:51 0147800201.tar.gz
-rw-r--r--   1 users         301 Sep 26 14:54 new_ODF_calclosed
226 Transfer complete.
```

In this session, we see that there is only one observation available, with observation ID 0147800201. However, with the ftp command **mget** (having first turned prompts off with the **prompt** command) all gzipped observations can be downloaded unattended. If there are many observations to download, this can take some time.

```
ftp> prompt
Interactive mode off.
ftp> mget *.gz
local: 0147800201.tar.gz remote: 0147800201.tar.gz
227 Entering Passive Mode (193,147,152,102,123,193)
```

```
150 Opening BINARY mode data connection for 0147800201.tar.gz (112104770 bytes).
226 Transfer complete.
112104770 bytes received in 152 secs (7.2e+02 Kbytes/sec)
ftp> exit
221-You have transferred 112104770 bytes in 1 files.
221-Total traffic for this session was 112107073 bytes in 4 transfers.
221-Thank you for using the FTP service on xmm.vilspa.esa.es.
221 Goodbye.
```

Now the data needs to be unpacked into /xmm/archive/flight/orbits with the softlinks in /xmm/current/flight/calev/orbits. I've written a tool which does all this in one go, called **obs_unpack**.

```
> obs_unpack -Vx *.gz

0147800201.tar.gz contains data for rev 0669, obs ID 0147800201
Copying 0147800201.tar.gz to /xmm/archive/flight/orbits/0669/0147800201/ ...
Unpacking 0147800201.tar.gz...
Creating PMS directory structure and moving files...
Setting file permissions and ownership...
```

obs_unpack is a Perl script installed in /usr/local/bin. It expects to be passed files which are either tarfiles or tarballs (gzipped tarfiles) in the standard Vilspa XMM packaging format. **obs_unpack** is set to run as root even if the user running it does not have root permissions. This is achieved by ensuring that the **obs_unpack** executable is owned by root and has its sticky permission bits set.

Calibration data needs to be owned by the xra group. The **-x** switch to **obs_unpack** ensures this.

Once **obs_unpack** has finished, you will need to delete the files you have downloaded.

The full URL for cal closed data can be summarised as ftp://epic_ex:20epic_ex02@xmm.vilspa.esa.es/new_week/calclosed/.

Orbit-per-week data

The procedure for orbit-per-week data is almost the same as that for calibration data. Every few weeks (and not every week as you might expect), I receive email notification from Michael Smith (msmith@xmm.vilspa.esa.es) that a complete set of data for a particular orbit or orbits are available for download. We tend to get every fifth revolution's worth.

An orbit-per-week download and unpacking session is shown below. Note that although the data is retrieved from the same FTP server as calibration data, the user account is different. This time the details are…

Username: accesspi
Password: accesspi02

```
> cd /xmm/archive/flight/orbits/latest
> ftp xmm.vilspa.esa.es
Connected to xmm.vilspa.esa.es (193.147.152.102).
220-    Welcome to the XMM-Newton SOC ftp server
220-
220 xmm.vilspa.esa.es FTP server ready.
Name (xmm.vilspa.esa.es:ljg): accesspi
331 Password required for accesspi.
Password: accesspi02
230-XMM-Newton SOC - European Space Agency (ESA)
230-Villafranca del Castillo, Madrid, Spain
230----------------------------------------------------------------------
230-Time: Fri Oct  3 13:49:59 2003.
230-
230-You are entering as accesspi from epic4.star.le.ac.uk.
230-
230-Server maintained by ftp-admin
230-
230-Last update: June 14, 2002
```

```
230-------------------------------------------------------------------
230-
230-
230 User accesspi logged in.  Access restrictions apply.
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> cd odf
250 CWD command successful.
ftp> prompt
Interactive mode off.
ftp> mget *.gz
```

Once all the files have been downloaded, you can disconnect from the FTP server and unpack with **obs_unpack** as before. This time however, you need to ensure that the **–x** switch is *not* used, so that all the data (which we almost certainly don't have scientific rights to) ends up belonging to the `epic` group.

```
> obs_unpack -V *.gz
```

The full URL for orbit-per-week data can be summarised as ftp://accesspi:accesspi02@xmm.vilspa.esa.es/odf/.

Housekeeping (SPEVAL) data

This task again involves retrieving files from the Vilspa XMM FTP server, but it's mostly automated.

A Perl script called **speval-get**, located in `/home/ljg/scripts/speval-get` is run as a cron job by root every Monday, Wednesday and Friday at 19:00. It connects to xmm.vilspa.esa.es anonymously and downloads all MOS, PN and RM SPEVAL files. They are downloaded into the temporary directory `/tmp/SPEVAL` before being gunzipped and placed into their proper locations within `/xmm/archive/flight/hk`.

When Vilspa first started producing SPEVAL files, they were hideously bloated with redundant whitespace. I wrote a simple tool called **speval-crush** which removes this (**speval-crush** can be found in `/home/ljg/scripts/`). It's not really necessary to bother with **speval-crush** anymore, but I periodically run all the SPEVAL files through it anyway.

SPEVAL files are stored in beneath `/xmm/archive/flight/hk` in directories named after the instruments they relate to: `m1`, `m2`, `pn` and `rm`. Once downloaded from Vilspa, they have a filename extension of `.dat`. If run through **speval-crush**, they get an additional filename extension of `.red` (short for reduced).

The full URL for SPEVAL data can be summarised as ftp://xmm.vilspa.esa.es/pub/speval/.

XMM Current Calibration Files (CCF)

These files are also downloaded by FTP from xmm.vilspa.esa.es. Details of the CCFs can be found at http://xmm.vilspa.esa.es/external/xmm_sw_cal/calib/.

Because the CCF archive at Vilspa contains *all* CCFs, a different mechanism is used to keep our copies up to date. Our CCF files are stored in `/usr/local/xmm_ccf` (this isn't really the best place for them – they ought to go into `/xmm/archive/flight/ccf` or somewhere similar with the rest of our data).

CCF files are kept up to date using an application called mirror, available from http://sunsite.org.uk/packages/mirror/. The software is installed in `/home/ljg/scripts/mirror`, and it is configured by editing the files `mirror.defaults` and `xmm-public-ccf`.

A cron job is run by root every Monday at 21:00. It simply executes mirror with the arguments `-pxmm-public-ccf mirror.defaults`.

`mirror` only downloads those files that aren't already present on epic4. It maintains its own log of which files it has already retrieved in `/usr/local/xmmsas_ccf/.mirror`.

Backups

Backups are a problem on epic4 as there is over 1TB of online storage available, and only a single DDS4 tape drive, with a maximum capacity of 40GB, for backups.

Most of our data is static, or changes rarely. This is backed up irregularly onto as many tapes as necessary. The contents of `/xmm/archive/ground` doesn't change, for example, so a single tape holds the entire contents of that disc.

Labelled tapes are provided. Whenever a backup is performed, the date should be recorded on the tape's box insert.

`/xmm/archive/flight` is backed up onto a number of tapes as so:

Contents	Last backed-up
0014-0099	6 Oct 2003
0100-0199	6 Oct 2003
0200-0399	7 Oct 2003
0400-0499	7 Oct 2003
0500-0599	2 Oct 2003
0600-0699	8 Oct 2003
hk (SPEVAL)	13 Oct 2003

Because these don't all sit in their own partition, the data can't be archived to tape with the dump command. Instead they are backed up with the following commands for the orbital data:

```
> cd /
> find xmm/archive/flight/orbits/pattern -print | cpio -oav -C 512 > /dev/rst0
```

pattern is a simple regex and is one of

- 00* for orbits 0014-0099
- 01* for orbits 0100-0199
- 0[23]* for orbits 0200-0399
- 04* for orbits 0400-0499
- 05* for orbits 0500-0599
- 06* for orbits 0600-0699

(orbits 200-399 happen to fit onto a single DDS4 tape).

The SPEVAL housekeeping data is copied to tape with a similar command:

```
> cd /
> find xmm/archive/flight/hk -print | cpio -oav -C 512 > /dev/rst0
```

In all cases, data can be restored with the cpio command:

```
> cd /
> cpio -idmv -H newc -C 512 < /dev/rst0
```

and the contents of a tape examined with:

```
> cpio -it -C 512 < /dev/rst0
```

Other filesystems are backed up onto tape using the **dump** command where possible, e.g.:

```
> dump -0au -b 64 -f /dev/rst0 /xmm/archive/ground
```

and restored with the **restore** command.

At no particularly regular time, the system partitions (/, /boot, /usr and /var) are backed up to a single tape with the **dump** command.